Abstract

A compact, lightweight direct methanol fuel cell unit includes a circular membrane electrode assembly (MEA) having a cathode, a proton exchange membrane (PEM), and an anode, an air flow duct on the cathode side of the MEA, an annular fuel reservoir on the anode side of the MEA which contains a mixture of methanol and water as fuel, a carbon dioxide (CO_2) relief valve communicating with the fuel reservoir, and a control unit. Due to the CO_2 release mechanism, the fuel cell is completely self-sustaining without the need for a mechanical auxiliary system. Additionally, the control unit improves the stability of the fuel cell power output and the catalysis activity of the MEA. Another embodiment of the present invention is a direct methanol fuel cell system which incorporates a number of MEAs and a fuel cell reservoir. All the cathodic electrical terminals of the MEAs are serially connected together while they are electronically communicating with the control unit. The anodic electrical terminals similarly communicate electronically with the control unit. Higher power and voltage are thus attained while maintaining a compact size of the fuel cell system.